WHICH METHOD IS THE MOST EFFECTIVE FOR REDUCING POST-THYROIDECTOMY PAIN: BILATERAL SUPERFICIAL CERVICAL BLOCK OR WOUND INFILTRATION? A PROSPECTIVE RANDOMIZED, DOUBLE-BLIND STUDY

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ABSTRACT

Aim: Thyroid surgery is a common operation, and pain is a significant problem in this operation. The aim of our study was to compare the postoperative analgesic efficacy of local anesthetic wound infiltration and bilateral superficial cervical block by measuring the 24-hour postoperative morphine requirements and postoperative pain intensity scores after thyroidectomy.

Materials and methods: This study included 60 patients who were scheduled for a thyroidectomy. The patients were divided into two groups. Bilateral superficial cervical block with 20 ml 0.25% bupivacaine plus 1:200,000 epinephrine and wound infiltration with 0.9% 20 ml NaCl was performed in Group A, while bilateral superficial cervical block with 20 ml 0.9% NaCl and wound infiltration with 0.25% 20 ml bupivacaine plus 1:200,000 epinephrine was performed in Group B after skin closure. Postoperative pain was evaluated by Visual Analog Score. All patients were given diclofenac sodium at 12-hour intervals. If the patient’s pain score was ≥4, 5 mg of morphine was given. The occurrence of nausea, vomiting and side effects was recorded.

Methods: The number of patients requiring morphine for 24 hours after surgery and the total postoperative morphine consumption for 24 hours were significantly lower in Group B compared to the same values in Group A (P=0.028 and P=0.01, respectively). The first analgesic requirement time was significantly longer in Group B than it was in Group A (1168±553.40 min vs 812±684.23 min, P=0.031). The postoperative VAS pain scores in Group B were significantly lower than they were in Group A at PACU admission (P=0.046), discharge from PACU (P=0.041), postoperative 8 (P=0.001), 12 (P=0.025) hours.

Conclusions: We conclude that local anesthetic wound infiltration was more effective than bilateral superficial cervical block in reducing post-thyroidectomy pain.

Key words: Wound infiltration, bilateral superficial cervical block and thyroidectomy pain.

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Background

Thyroid surgery is a common operation, and pain is a significant problem in this operation, especially during the first 24-hour postoperative period. Additionally, nausea, vomiting and pain during swallowing are frequently observed after this procedure. The severity of these complaints affects the patient’s hospital stay and postoperative recovery. Opioids, nonsteroidal anti-inflammatory drugs and regional techniques such as bilateral superficial cervical block (BSCPB), bilateral combined superficial and deep cervical block local anesthetic and wound infiltration (LWI) are used to decrease post-thyroidectomy pain (1-3).

BSCPB is an easily applicable procedure, and its effectiveness in the treatment of post-thyroidectomy pain has been shown in some studies (2,4-6). Additionally, LWI is an alternative and acceptable method for post-thyroidectomy pain relief (7-8).

The aim of the present study was to compare the analgesic efficacy of BSCPB and LWI by measuring the 24-hour postoperative morphine requirements and postoperative pain intensity scores after thyroidectomy.

Methods

This randomized, prospective, double-blind clinical trial was performed between August and
December 2013 after obtaining approval from the local ethical committee of Ataturk University Medical School (registration number: B.30.2.ATA.0.01.00/179) and receiving written informed consent from the patients. Sixty patients over the age of 18, classified as American Society of Anesthesiologists class I-II and scheduled for thyroidectomy, were included in this study. All of the patients were euthyroid. Patients were excluded if they had a recent history of opioid, steroid or any analgesic drug use. Patients were also excluded if they had coagulation disorders; medication or anesthetic agent allergy- or intolerance-history (medications or agents used in the study); redo operations; substernal goiters, thyroidectomy requiring lymph node dissection; pregnancy; superficial cervical block- or wound infiltration-contraindications (e.g., local infection or sepsis); and local anesthetic allergy. In addition, patients were excluded if they were unable to understand the Visual Analog Score (VAS) or if they refused to participate.

The patients were divided into two equal groups by computerized randomization: Group A, bilateral superficial cervical block with 20 ml 0.25% bupivacaine plus 1:200,000 epinephrine + wound infiltration with 0.9 % 20 ml NaCl, and group B, wound infiltration with 0.25 % 20 ml bupivacaine plus 1:200,000 epinephrine + bilateral superficial cervical block with 20 ml 0.9% NaCl.

These group assignments were placed in sealed envelopes with the sequence number. A person independent from the study prepared the randomization and sealed the envelopes.

The sealed envelopes and randomization were prepared by people who were independent from the study. The envelopes were opened outside the operation room on the day of the surgery by an anesthetist who was familiar with these techniques. In supine position, the sternocleidomastoid muscle (SCM) was determined by head elevation and head turned away from the side to be blocked. The BSCP was then performed using a three-point injection technique. A 22-gauge needle was inserted at the midpoint of the lateral border of the SCM in the subcutaneous plane, corresponding to the landmarks of the C-6 transverse process and mastoid process. After confirming negative aspiration in the blood, 6 ml of the prepared solution was injected in the craniocaudal and caudal directions to block the auricular, occipital and supraclavicular branches of the superficial cervical plexus. The needle was then reoriented in a horizontal direction above the SCM, and after confirming negative aspiration, 4 ml of solution was injected to block the transverse cervical nerve. This process was also performed on the other side of the neck. LWI was performed using a 22-gauge needle inserted throughout the incision area, and 20 ml of solution was administered in the subcutaneous layers of the incision area. The patients were extubated at the end of the surgery using 0.5 mg atropine IV and 1.5 mg neostigmine IV; they were then transferred to the post-anesthesia care unit (PACU).

The patients stayed in the PACU for 2 hours (h) and were then transferred to the ward. Postoperative pain was evaluated using the VAS (0: no pain, 100: worst imaginable pain). The pain scores were recorded upon PACU admission (H0) (when patients were fully awake and cooperative), before discharge from the PACU (H2), and at 4, 8, 12, 16 and 24 hours postoperative (H4, H8, H12, and H24). All patients received diclofenac sodium i.v. at 12-h intervals; the first dose was administered 30 min before the end of surgery. Additionally, if the patient’s pain score was 4 or higher in the PACU on the ward, 5 mg of morphine was
administered subcutaneously. The first analgesic requirement time (minutes) was defined as the elapsed postoperative time between the administration of the study solutions and the time when the VAS≥40. The total dose of morphine required in the first postoperative 24-hour period was recorded. Prophylactic antiemetics were not administered. Nausea and vomiting were assessed by postoperative nausea and vomiting (PONV) score (1= no nausea, 2= mild nausea, 3=severe nausea, 4=retching and/or vomiting). Severe PONV was defined as grades 3- 4, and mild or non-PONV was defined as grades 1-2(9). Severe PONV was treated with 8 mg ondansetron i.v. as a rescue antiemetic. The following data and measurements were recorded: total duration of surgery; occurrence of PONV, urticaria, urinary retention and postoperative swallowing pain; use of rescue antiemetics and sedation; and complications of the block (diaphragmatic palsy, brachial plexus block, hematoma).

Outcome
The primary outcome of the study was the total dose of morphine consumption in the 24-hour postoperative period. The secondary outcomes were PONV, rescue antiemetics requirement, VAS at specific times, complications of the block and morphine-related side effects. In our preliminary study, we found that the total morphine consumption in the 24-hour postoperative period was 14 ±5 mg in Group A and 9±5 mg in Group B. We thought that the difference between the two groups was at least 4 mg. Accordingly, we determined that the number of patients required in every group was 25, based on power of 80%, alpha error of 0.05 and beta error of 0.20.

Statistical Analysis
SPSS version 18 software programme was used to perform the statistical analysis. The distribution of the variables was evaluated for normality using the Kolmogorov-Smirnov test. Descriptive statistics are expressed as the mean±standard deviation (SD). Categorical variables were analyzed using the chi-square test. The normally distributed data comprising continuous variables were analyzed using Student’s t-test. A value of P< 0.05 was considered statistically significant.

Results
Sixty patients were enrolled the study, and each group consisted of 30 people. The patient characteristics and operative data were similar in both groups (Table 1). The postoperative data are summarized in Table 2.

| Table 1: Patient Characteristics and Operative Data. Values are expressed as the mean ±SD or number (n). There were no significant differences between the groups. |
|-----------------|-----------------|-----------------|
|                  | Group A (n=30)  | Group B (n=30)  |
| Age (year)       | 44.30±12.7      | 46.20±10.13.2   |
| Weight (kg)      | 71.30±5.10      | 72.20±5.06      |
| Duration of surgery (min) | 143.30±23.32     | 137±20.42       |
| Male/Female      | 6/24            | 4/26            |
| Unilateral thyroidectomy | 10              | 12              |
| Bilateral Thyroidectomy | 20             | 18              |
| Multinodular goiter | 16             | 16              |
| Thyroid cancer   | 4               | 2               |
| Nontoxic solitary nodule | 10              | 12              |

The number of patients requiring morphine in the 24-hour period after surgery and the total postoperative morphine consumption for 24 hours were significantly lower in Group B compared with the values in Group A (respectively p=0.028 and p=0.01). The first analgesic requirement time was
significantly longer in Group B than it was in Group A (1168 ± 553.40 min vs 812 ± 684.23 min, p=0.031). There was no significant difference between the groups in the number of patients with no morphine requirement in the PACU (p=0.09). Twenty-two patients developed PONV.

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=30)</th>
<th>Group B(n=30)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First analgesic require-ment time (min)</td>
<td>812 ± 684.23</td>
<td>1168 ± 553.40</td>
<td>0.031*</td>
</tr>
<tr>
<td>Number of patients with no morphine requirement in PACU</td>
<td>18 (42.9%)</td>
<td>24(57.1%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Number of patients with morphine requirement within 24 h after surgery</td>
<td>14 (70%)</td>
<td>6(30%)</td>
<td>0.028**</td>
</tr>
<tr>
<td>Total postoperative morphine consumption in 24 hours (mg)</td>
<td>14.30±4.32</td>
<td>8.75±4.43</td>
<td>0.01***</td>
</tr>
<tr>
<td>Number of patients with PONV (all/severe)</td>
<td>12/3</td>
<td>10/4</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Postoperative Data.
Values are expressed as the number (%) or mean ±SD.
*p= 0.031 compared with group A.
**p= 0.028 compared with group A.
***p=0.01 compared with group A.

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=30)</th>
<th>Group B (n=30)</th>
<th>p Value</th>
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</thead>
<tbody>
<tr>
<td>H0</td>
<td>32.66 ± 19.80</td>
<td>24.33 ± 10.40</td>
<td>0.046*</td>
</tr>
<tr>
<td>H2</td>
<td>25.30 ± 12.80</td>
<td>19.33 ± 9.07</td>
<td>0.041*</td>
</tr>
<tr>
<td>H4</td>
<td>26 ± 11.60</td>
<td>22.30 ± 8.97</td>
<td>0.17</td>
</tr>
<tr>
<td>H8</td>
<td>32.66± 5.83</td>
<td>19.33 ± 9.73</td>
<td>0.001*</td>
</tr>
<tr>
<td>H12</td>
<td>28±10.60</td>
<td>22.66±6.90</td>
<td>0.025*</td>
</tr>
<tr>
<td>H16</td>
<td>20±8.30</td>
<td>22±8.46</td>
<td>0.36</td>
</tr>
<tr>
<td>H24</td>
<td>12±4.06</td>
<td>13±6.06</td>
<td>0.32</td>
</tr>
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</table>

Table 3: Visual Analog score (VAS) for 24 hours after surgery.
Values are expressed as the mean ±SD. H0= PACU admission, H2=discharge from PACU, H8, H12= at 8 and 12 hours postoperative, respectively. The VAS was significantly lower in Group B when compared with Group A at H0, H2, H8, and H12 (p=0.046, p=0.041, p=0.001, p=0.025, respectively).

Twelve patients in Group A and ten patients in Group B. Severe PONV occurred in three patients in Group A and in four patients in Group B.

The postoperative pain scores are summarized in Table 3. The postoperative VAS pain scores in Group B were significantly lower than the scores in Group A at H0, H2, H8 and H12 (p=0.046, p=0.041, p=0.001, p=0.025, respectively). There was no significant difference in the VAS pain scores between the groups at H4, H16, or H24 after surgery. There were no complications of the block or morphine-related side effects in any group.

Discussion

The present study found that LWI significantly decreased the total postoperative morphine consumption in the 24-hour postoperative period in thyroid surgery compared with BSCBP. Furthermore, we found that the first analgesic requirement time was significantly longer in the LWI group than it was in the BSCBP group.

LWI is a simple technique that is used for postoperative analgesia, and studies have shown that LWI can effectively reduce postoperative pain after various surgical procedures (7,10). However, the literature is confusing concerning post-thyroidectomy pain. Although some studies have demonstrated that LWI reduced post-thyroidectomy pain (1,11), other studies have shown that LWI was not effective for pain control (12,13).

We found only one study in the literature on thyroid surgery that was similar to our study. Following endotracheal intubation, Eti et al. (12) administered BSCPB with a total of 30 ml of 0.25% bupivacaine in both sides of the neck in Group I and LWI with 20 ml of 0.25 bupivacaine in group II. A regional block was not carried out in Group III (control group). As a result, they found that neither BSCPB nor LWI with 0.25% bupivacaine decreased the opioid requirement or pain scores after thyroid surgery. In addition, they reported that the first analgesic requirement time was longer in the BSCBP groups than it was in the controls, but no significant difference was found between their Groups I and II in terms of this variable. In our study, the total morphine consumption was shown to be less in the LWI compared with the BSCPB during the first postoperative 24 hours. Additionally, the pain scores were found to be lower, and the first analgesic requirement time was found to be longer in the LWI group than they were in the BSCBP group within the first postoperative 24 hours. The possible explanation for the contrasting results of the two studies might be the differences in pain management. In our study, we used morphine subcutaneously for postoperative pain relief when the VAS≥40.

Furthermore, we regularly administered diclofenac sodium in 12-h intervals. Conversely, Eti et al. (12) administered 10 mg/mL meperidine as a 1.5 mL bolus when the VAS≥30 via IV-PCA for post-
operative analgesia; they did not administer any other analgesics. Additionally, the addition of epinephrine to bupivacaine is likely to extend the duration of the effect of the bupivacaine.

In some studies, opioids were used for post-thyroidectomy pain relief if the VAS was 30\(^{11,14}\), whereas other studies used opioids when the VAS was greater than 40\(^{11,13,14}\). In the study by Eti et al.\(^{12}\), the high total consumption of meperidine via PCA may have been related to the use of opioids when the VAS score was 30.

It is likely that post-thyroidectomy pain perception contains components that are related to deep and superficial layers of the wound, intraoperative neck position and wound drainage. This pain can be treated with nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids\(^{15}\).

In a study by Karamanlioglu et al.\(^{11}\), wound infiltration was performed at the end of the surgery and before skin closure. The researchers divided the patients into 4 groups. They administered 12 mL of normal saline in Group S, 10 mL of ropivacaine 0.75% with 2 mL of normal saline in Group R, 2 mL of lornoxicam with 10 mL of normal saline in Group L and 10 mL of ropivacaine 0.75% with 2 mL of lornoxicam in Group RL. Pethidine (meperidine) 1 mg/kg IM was given when the postoperative VAS>4. The researchers found that the pain scores were lower in the combination group compared with the pain scores in the controls during the first 12 hours, whereas the VAS was lower in the combination group compared with the lornoxicam and ropivacaine groups during the first postoperative 4 hours. They also reported that total opioid consumption was lower and the first analgesic requirement time was longer in the combination group than it was in the control group (14.8±8.4 hours in Group RL and 5.9±5.2 hours in Group S) during the first postoperative 24 hours.

The authors recommended the combination of local anesthetic and NSAID for thyroid surgery if wound infiltration was planned. Our study solution included local anesthetic and epinephrine, but we administered NSAIDs iv in 12-h intervals. The pain scores in our study were significantly lower in the LWI group than they were in the BSCPB group during the first postoperative 12 hours. Furthermore, the first analgesic requirement time was found to be 1168 ± 553.40 min in the LWI group, which is slightly longer than it was in the above-mentioned study. We suggest that morphine use could be the reason for this discrepancy. A limitation of this study might be the lack of a control group. However, when we designed this study, the LWI and BSCPB were administered with this solution in both of the groups to measure the placebo effect of 0.9% NaCl.

In their study, Dieudonne et al.\(^{15}\) found that BSCPB significantly reduced pain intensity scores in the early postoperative period and the amount of total morphine doses after thyroidectomy but that optimal pain relief was not accomplished by a BSCPB alone. These researchers suggested that a BSCPB could be integrated into a multimodal approach\(^{16}\). They performed BSCPB with 20 mL of 0.25% bupivacaine with 1:200,000 epinephrine at the end of surgery, and they stated that despite the use of acetaminophen, approximately 65% of the patients required morphine within the first postoperative 24 hours; the pain scores were lower in the BSCPB group in the postoperative period, especially in the PACU. In our study, however, additional analgesics were required in 70% of the patients in the BSCPB group and in 30% of the patients in the LWI group, despite the use of diclofenac sodium. The VAS scores were low in both groups during the first postoperative 12 hours. However, the VAS in the LWI group was significantly lower compared with the VAS in the BSCPB group.

Analgesic drugs were given before surgery in some studies\(^{12,17}\) and after the completion of the surgery in others\(^{(11,15)}\). Studies have proposed that the timing of analgesic drug administration could affect the efficacy of the drug by decreasing the sensitization of the nervous system induced by the nociceptive inputs. However, preemptive analgesia is argued in clinical and academical research\(^{18}\).

Combined deep and superficial cervical plexus block is an effective technique for reducing opioid requirements and postoperative thyroidectomy pain\(^{19}\). However, bilateral deep cervical block can cause diaphragmatic dysfunction, and due to these risks, we thus believe that this method should not be used.

In this study, no significant difference was observed between the groups in the incidence of nausea and vomiting, despite the decreased morphine consumption in the LWI group. The occurrence of PONV depends on several factors such as the anesthetic agents, inhalation anesthetics, nitrous oxide, intra- and postoperatively used opioids and pain; we could not avoid these factors. In addition, the primary objective of our study did not include...
the issue of PONV, and this topic could be the focus of another study. Furthermore, we did not observe any side effects such as morphine-related sedation and respiratory depression or a delay in wound healing due to wound infiltration and infection.

Conclusions

We found that bupivacaine 0.25% with 1:200,000 epinephrine LWI was more effective in reducing post-thyroidectomy pain compared with BSCBP and that this application decreased opioid consumption during the first postoperative 24 hours and prolonged the first analgesic requirement time. We recommend the use of LWI, which is a less invasive, simpler and safer method for reducing post-thyroidectomy pain.

Abbreviations
PACU, post-anesthesia care unit
VAS, visual analog score
BSCPB, bilateral superficial cervical block
LWI, local anesthetic and wound infiltration
IV, intravenous
SCM, sternocleidomastoid muscle
PONV, postoperative nausea and vomiting
NSAIDs, nonsteroidal anti-inflammatory drugs

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